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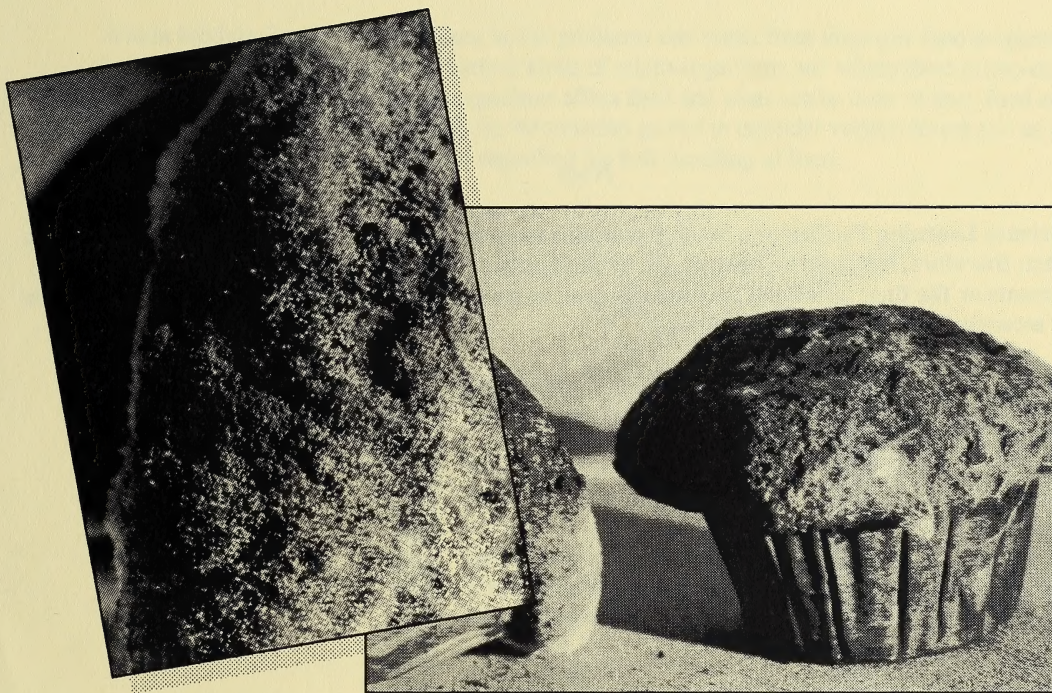
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SCIENCE 7

**LEARNING FACILITATOR'S
MANUAL**



MODULE 5: MICRO-ORGANISMS AND FOOD SUPPLIES



**Distance
Learning**

Alberta
EDUCATION

ACKNOWLEDGEMENTS

This module has been based on **Science Directions 7** by John Wiley & Sons/Arnold Publishing Ltd., 1989. Program consultant was Douglas A. Roberts. The author team for the complete text included Wilson C. Durward, Eric S. Grace, Gene Krupa, Mary Krupa, Alan J. Hirsch, David A.E. Spalding, Bradley J. Baker, and Sandy M. Wohl. Contributing author was Jean Bullard. Portions of **Science Directions 7** have been used throughout and have been adapted in a variety of ways.

Cover photographs courtesy of Bernie Galbraith, Edmonton.

Note

This Science Learning Facilitator's Manual contains answers to teacher-assessed assignments and the final test; therefore, it should be kept secure by the teacher. Students should not have access to these assignments or the final tests until they are assigned in a supervised situation. The answers should be stored securely by the teacher at all times.

Science 7
Learning Facilitator's Manual
Module 5
Micro-organisms and Food Supplies
Alberta Distance Learning Centre
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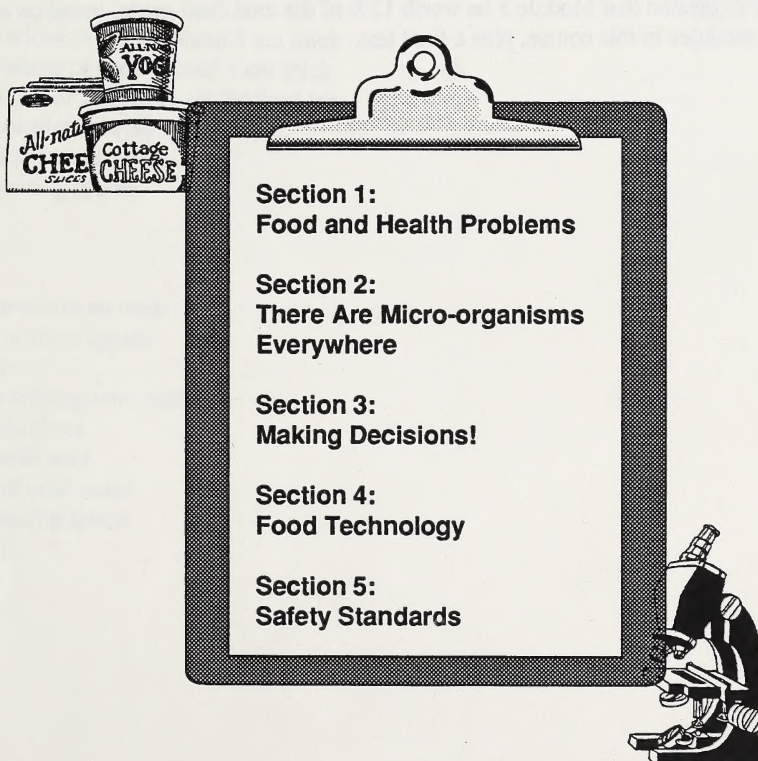
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Module 5 – Micro-organisms and Food Supplies: Overview

The major emphasis of this module is on science, technology, and society. However, concepts involving the other two emphases regarding the general nature of science and the relationship between science and technology are also present.

Module 5 examines how food is kept safe for human use. Students are given background information regarding scientific and technological developments. They then look at how various technologies are used in food preparation and preservation.

Within Module 5 students learn about health problems that result from improper food preparation and handling. They become aware of various kinds of micro-organisms and where these micro-organisms live. They learn about how micro-organisms affect food and what can be done to keep food safe from micro-organisms. Students then use the information gained to consider various issues and as a basis for making knowledgeable decisions regarding the safe handling of food.



Section 1: Food and Health Problems

Section 2: There Are Micro-organisms Everywhere

Section 3: Making Decisions!

Section 4: Food Technology

Section 5: Safety Standards

Evaluation

The student's successful completion of all assignments will depend on practice obtained while doing the various activities. Many choices of activities have been provided so that students have some control over their own learning.

The following distribution of marks is suggested in determining the student's grading for this module.

Section 1 Assignment	0%
Section 2 Assignment	31%
Section 3 Assignment	21%
Section 4 Assignment	26%
Section 5 Assignment	<u>22%</u>
TOTAL	100%

Note: There is no assignment to be completed for Section 1.

Although the value of each module for the Science 7 course is the decision of the classroom teacher, it is suggested that Module 5 be worth 12% of the total final grade, based on equal weighting of the six modules in this course, plus a final test.

Materials Needed for Module 5

Comment:

In order to assist students effectively in their study of this course, it may be helpful to preview Module 5. This will give you an idea as to how the topics are developed; it will also give you an overview of the materials needed in the module. In some cases if the materials suggested are not readily available, the learning facilitator may be able to substitute suitable materials for the student, so that the activities can be completed successfully.

The materials needed for Module 5 and the activities in which they are to be used are as follows:

Section 1: Activity 4

Note: Students may choose to do either Part A or Part B.

Part A

- salt
- two slices of potato, about 1 cm thick
- two slices of apple, about 1 cm thick
- four jars or glasses to set the food into
- lids or plastic wrap
- labels or grease pencil
- measuring spoon

Part B

- a stove with an oven
- two or three apples
- knife
- cake cooling wire rack
- cookie sheet
- ascorbic acid
- cup of cold water
- measuring spoon
- bowl

Section 2: Activity 1**Part A**

Note: Students may choose Part B, a videocassette pathway, or Part C, which does not require any materials.

- microscope
- prepared slides of micro-organisms
 - typical bacillus
 - typical coccus
 - spirillum
 - yeast
- lens tissue

Section 2: Activity 2

- tall glass jar (500 mL)
- ruler
- yeast
- measuring cup
- measuring spoon
- warm water
- 250 mL flour
- 10 mL sugar
- grease pencil
- large spoon
- large bowl

Section 3: Activity 1

- fruit
 - 1/2 orange or lemon
 - a few grapes
 - apple slices
- vegetables
 - thick potato slice
 - fresh green beans
 - zucchini or cucumber slices
- a slice of preservative-free bread
- 250 mL cottage cheese in its container
- 125 mL milk
- 10 mL of soil (not sterilized)
- two small jars with lids
- tape
- paper towels
- plastic wrap
- clear plastic bags
- cookie sheet or pan
- measuring spoon

Section 3: Activity 4**Part A**

Note: Students may choose Part B, which does not require any materials.

- 1 L pasteurized milk (whole or 2%)
- 10 g milk powder
- 30 mL plain yogurt OR 5 g yogurt culture
- measuring spoon
- saucepan
- thermometer
- 4 or 5 very clean containers with lids
- spoon

Section 4: Activity 1

Note: The following materials are needed if students will be trying to preserve some sliced apples by canning them. The canning portion of this activity is optional, and if it is done, the learning facilitator or another adult must be present to supervise and assist the student.

- five or six apples
- knife
- cutting board
- spoon
- clean cloth
- tongs
- mason jar with lid
- a saucepan large enough for the jar to fit inside
- a saucepan of about 2 L capacity
- stove

Media (Optional)

The following video programs are suggested if the students are to use the optional media learning pathways in Module 5. You may wish to preview them before using.

Section 2: Activity 1

Part B

The Microscope and Its Incredible World (21 minutes)

Section 2: Activity 4

Microbeasts and Disease (first 10 minutes)

Section 3: Activity 6

Microbeasts and Disease (middle portion of program)

Section 4: Enrichment

Part A

Microbeasts and Disease (last portion of program)

Note: Contact your nearest Regional Resource Centre, Urban Media Centre, or ACCESS Network for availability of the above video programs.

Section 1: Food and Health Problems

By the end of this section students should understand that

- health problems may result if food is not prepared, handled, or stored safely
- many years ago different societies developed ways to prevent food from making them ill
- they can help to decide what foods are safe to eat and how to keep them that way

Section 1: Activity 1

1. Name two types of micro-organisms that cause many health problems.
 - *viruses*
 - *bacteria*
2. When micro-organisms multiply on food, the increased number of micro-organisms can make the food unsafe to eat. Search the Health Problems chart for information about what conditions help micro-organisms multiply. List three conditions that help bacteria to multiply quickly.
 - *warmth*
 - *presence of moisture*
 - *presence of oxygen (from air)*
3. In the Health Problems chart you should have noticed a few hints on how to handle food safely. What are some precautions that should be taken when handling food to reduce the risk of spreading micro-organisms which could cause disease?
 - *washing hands after using the bathroom*
 - *not coughing or sneezing around food*
 - *keeping some foods in cold, dry places*

Section 1: Activity 2

Refer to the illustration on page 281 of the textbook to answer the following questions.

1. Which of the ways of packaging and storing food shown deprives micro-organisms of moisture?
Packaging food in a box (shredded wheat) or storing in a covered container (parmesan cheese, dried peas) deprives micro-organisms of moisture.
2. Which of the ways of packaging and storing food shown deprives micro-organisms of warmth?
Freezing (green beans and the bacon) deprives micro-organisms of warmth.

3. Which of the ways of packaging and storing food shown helps keep micro-organisms from contacting the food?

All of the packages shown keep micro-organisms from the food to some extent, but the canned food and bacon are completely cut off.

Section 1: Activity 3

You have invited some of your friends over for a meal on a warm summer day. They are to arrive about 5 p.m. You have to prepare at least some of the food in the morning because you are busy all afternoon.

Here is your menu:

- chicken noodle soup (from a can)
- egg salad sandwiches (bread, butter, mayonnaise, onion, eggs)
- potato chips
- fresh fruit salad with whipped cream
- milk

1. Which two foods are quickest to get ready and can be left until just before serving time?

The milk and potato chips can be left to get ready just before serving time.

2. Which two foods will take time to prepare and may need to be prepared in the morning?

The egg salad sandwiches and the fresh fruit salad with whipped cream may need to be prepared in the morning.

3. How would you keep the following foods from growing micro-organisms if you had to prepare them well before 5 p.m.?

- a. egg salad sandwich

wrap and refrigerate

- b. potato chips

leave them sealed in the package

- c. fresh fruit salad

wrap and refrigerate

- d. whipped cream

place in a sealed container and refrigerate

- e. milk

place in a sealed container and refrigerate

Section 1: Activity 4

Note: Students are to do either Part A or Part B, but they may do both parts if they wish.

Part A

Observations

	0 minutes	15 minutes	1 hour	1 day
potato – no salt	<p><i>Answers will vary. Check to see that the observations the student stated here are used as the basis for answering the questions which follow.</i></p>			
potato – salt				
apple – no salt				
apple – salt				

Questions to Answer

1. What happened to the salted slices?

Answers will vary. A sample answer is given.

A clear, runny liquid began to appear around the potato slices during the first day, becoming increasingly thick and murky the following day. Eventually the salt disappeared and the top of the potato turned brown.

2. What happened to the unsalted slices (the control)?

Answers will vary. A sample answer is given.

Some clear liquid appeared during the first day, but not as much as in the salted slices. After the next day, the liquid became murky and the potato became dull grey on top.

3. a. Does just salting food prevent micro-organisms from multiplying in it?

No. (Salting food helps but is not sufficient to prevent micro-organisms.)

- b. Explain.

Answers will vary. Students should note that the salted potato did not decay in the way the control set-up did, but that the food did spoil somewhat. To keep micro-organisms from the food it should also be dried.

Part B

Drying food removes the water. Most foods need very special conditions of moisture, temperature, and air flowing around them to be dried properly. Drying fish and meat can be very dangerous if not done correctly.

4. What do you think the danger might be?

Answers will vary. Students should note that if micro-organisms are allowed to infect the meat or fish, those eating it might become sick.

5. How long were the apples left in the oven?

Answers will vary. Note that 3 to 6 hours is a normal range of time required.

6. Describe the appearance of the apple slices after taking them out of the oven.

The slices will discolour somewhat from their original pure white condition and will lose much of their volume.

7. How do you think the drying helps prevent micro-organisms from growing on the food?

Answers will vary. Students should note that there is less moisture for the micro-organisms to use.

Section 1: Follow-up Activities

Extra Help

Search the Health Problems chart given in Activity 1 for information to answer the following questions.

1. List two places where a virus can be found.

A large number of answers could be given based on the Health Problems chart. Any two of the following answers are acceptable.

- *in the air*
- *on objects*
- *on the hands*
- *in soil*
- *on poultry*
- *on some wild animals*
- *in milk*
- *in dairy products*
- *in eggs*

2. List three places where salmonella bacteria can be found.

- *in poultry*
- *on eggs*
- *in dairy products*

3. What are two ways that bacteria and viruses can get into your body?

Any two of the following example answers are acceptable.

- *by eating food with bacteria on it*
- *by breathing in the bacteria*
- *by touching the bacteria and then touching your mouth*

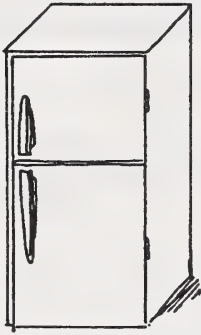
4. What will happen to you if these bacteria and viruses get into your body?

You will become sick.

5. Why is it important for you to wash your hands after using the bathroom?

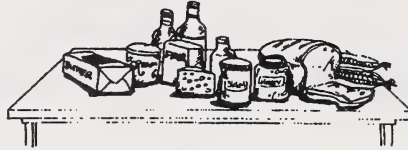
You might have come in contact with bacteria which you may then transfer to food or to other people.

6. Compare the following situations. Which will allow micro-organisms to multiply, and which will prevent micro-organisms from multiplying? Give reasons for your answers.



- a. food kept in a refrigerator

Micro-organisms can grow but not very quickly because of the cold.



- b. food left out on a table

Micro-organisms can get at the food from being exposed to the air and grow quite quickly.

7. Compare the following situations. Which will allow micro-organisms to multiply, and which will prevent micro-organisms from multiplying? Give reasons for your answers.



- a. food kept in a jar with a tightly sealed lid

This procedure can prevent micro-organisms from multiplying, but only if there are none in the food to start with.



- b. food in a jar with the lid off

Micro-organisms can get at the food from being exposed to the air and grow quite quickly.

8. a. Raisins are dried grapes. Raisins can be bought in cardboard boxes and will remain safe to eat for a few weeks without refrigeration. Would grapes be safe if they were stored in the same way?

No.

- b. Give reasons for your answer.

The moisture in the grapes provides a place where micro-organisms might grow.

9. Beef jerky is made of strips of beef meat that have been dried, salted, and flavoured. In many stores, beef jerky is kept in a jar at the sales counter, but beef meat is kept well wrapped and in a freezer. Why is beef jerky so much easier to store?

The beef jerky does not need to be refrigerated. (The beef jerky does not support the growth of micro-organisms in the same way the beef does because it has been dried and salted to prevent their growth.)

Enrichment

1. a. In the following chart, list six foods you would like to take for your lunch at school.
- b. Assume your lunch sat in your locker over the weekend. Opposite the list of foods, write *yes* if you think the food would be safe for you to eat on Monday. Write *no* if you think the food would not be safe to eat. (Use the Health Problems chart to help you with your answers.)

Name of Food	Yes or No
<p><i>Answers will vary depending on the six foods the student selected for lunch. Check to see how reasonable the student's food selection is and as to whether the foods spoil easily or not.</i></p>	

- c. Explain why each food in the chart would or would not be safe to eat.

Answers will vary. Student answers should show evidence of critical thought and a realistic concern for their own safety.

Comment:

There is no assignment for Section 1.

Section 2: There Are Micro-organisms Everywhere

When students have finished this section, they should be able to describe

- what some micro-organisms look like
- where some micro-organisms can be found
- what conditions are needed for micro-organisms to grow

Section 2: Activity 1

Note: Students are to do either
Part A, Part B, or Part C.

Part A

Comments:

Part A involves using a microscope to observe prepared slides of micro-organisms. Emphasize to students that a microscope is a valuable and delicate instrument. Special care is required when using a microscope. Be sure the student understands how to handle and take care of the particular model of microscope that they are using.

Observations

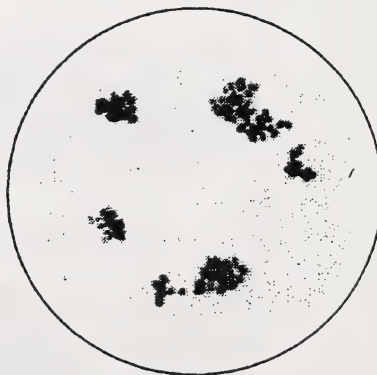
Learning facilitators should view slides to be used with this activity. Diagrams should show general features of materials viewed.



Typical Bacillus

overall shape: *irregular (random spacing)*

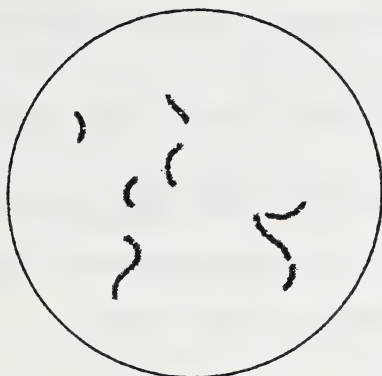
shape of each cell: *rod shaped*



Typical Coccus

overall shape: *clumps*

shape of each cell: *rounded*



Spirillum

overall shape: *curves and spirals*

shape of each cell: *curved rods*



Yeast

overall shape: *irregular (random spacing)*

shape of each cell: *rounded (oval)*

The yeast cells will appear much smaller than shown when viewed through student microscopes.

Questions to Answer

Make the necessary interpretations to answer the following questions.

1. The eyepiece is a 10X eyepiece. Magnification using the 4X objective makes the object appear 40 times larger than it really is.

The eyepiece magnifies by 10.

The objective magnifies by 4.

$$\begin{array}{c} \diagup \\ \diagdown \end{array} 10 \times 4 = 40$$

- a. What would the magnification be using the 10X objective with the 10X eyepiece?

100 times

- b. What would the magnification be using the 40X objective with the 10X eyepiece?

400 times

2. The yeast cells you observed have the same general shape as one of the first three kinds of bacteria you examined. Which of the three do the yeast cells look most like?

The shape of the individual cells is most like the coccus form.

3. Most of the bacteria found in food are like the bacillus or coccus that you observed. These may be helpful or harmful. How could you tell the difference between these two bacteria?

The bacillus cells were scattered and rod shaped. The coccus were in clumps and more rounded in shape.

4. The yeast slide may show some of the yeast cells dividing. How do you think they do this?

A small part grows out from the main cell. This part breaks off and becomes a new cell.

5. Which of the slides showed the cells in groups or clumps?

yeast and coccus

6. What is the benefit to the micro-organism when it lives in food?

The food is the material in which the micro-organisms live and it serves as their food as well.

Part B

Comments:

The videocassette *The Microscope and Its Incredible World* shows students how to use a microscope and what many small organisms and micro-organisms look like through a microscope.

Students are to view the videocassette (about 21 minutes long) and then answer the following questions.

7. Why is a microscope like two magnifying lenses?

The microscope contains at least two lenses which are the main parts of the microscope.

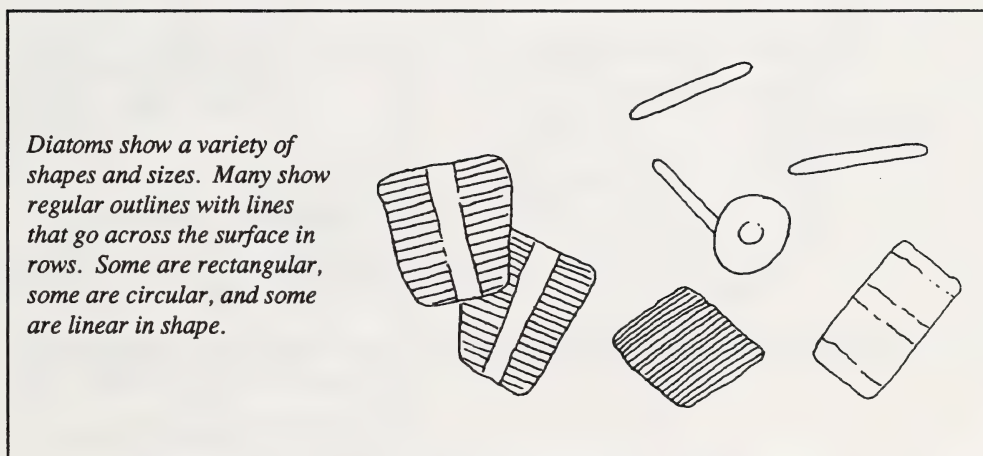
8. If you combined a 10 power eyepiece with a 20 power objective, what would the overall power or magnification be?

200 times

9. Number the following steps of how to use a microscope in the order that you would do them.

- 3 Place your eye directly above the eyepiece.
- 5 Use the fine focus knob to bring the specimen into focus.
- 2 Rotate the nosepiece so that the objective with the lowest power is directly above the stage hole.
- 1 Place the slide on the stage beneath the stage clips.
- 4 Turn the coarse focus knob slowly until the specimen comes into rough focus.
- 6 Change to a higher power objective.

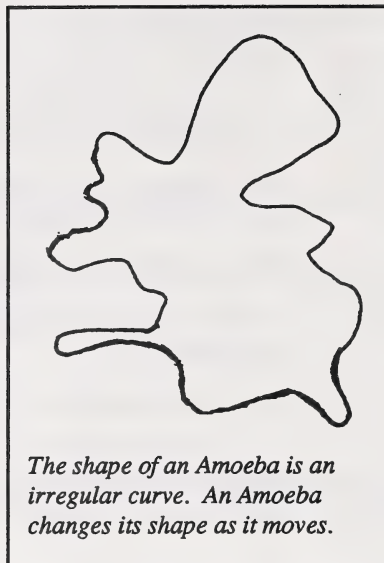
10. Describe or draw the shape of diatoms, the world's smallest plants. (These are shown a little after the insects in the videocassette. You may need to use the pause button to examine them closely.)



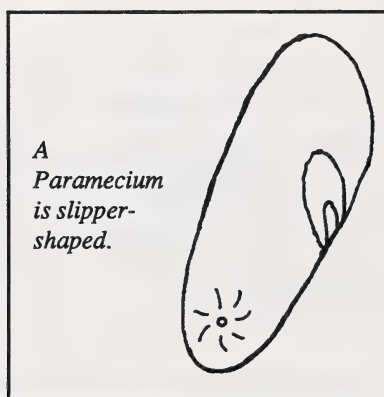
11. Estimate the number of protozoa in the one drop of pond water viewed through the microscope. Circle the number closest to your estimate.
- a. 10
- b. 100
- c. 1000

Answers may vary with pond water sampled.

12. Describe or draw the shape of an *Amoeba*.



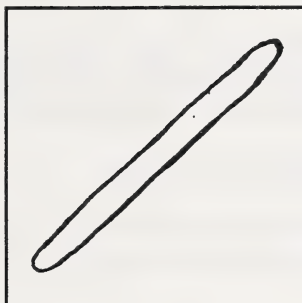
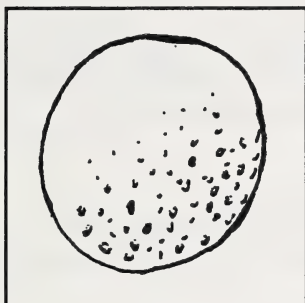
13. Describe or draw the shape of a *Paramecium*.



14. What are cilia (the hairlike structures on protozoa) used for?

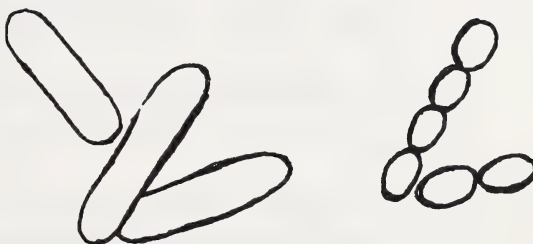
They are used to move the protozoan.

15. Colonies are groups of micro-organisms living together. Draw the shapes of two different colonies.



16. Describe or draw the shape of bacteria. (These are shown near the end of the videocassette.)

Bacteria have many different shapes. The ones shown in the videocassette are mainly rod-shaped, sausage-shaped, or elliptical.



17. Why is the microscope referred to as “a passport to an incredible, new world”?

Without the microscope, people would not be able to see a tremendous variety of organisms that form a significant part of our world.

Part C

Comments:

Even though students may not have a microscope, they should become familiar with the proper use and care of a microscope before observing diagrams of micro-organisms. Questions 18 and 19 are based on information found on pages 368 to 370 of *Science Directions 7*.

18. What is a compound microscope?

The microscopes used in science classes are compound microscopes. Viewing is done through a series of lenses to improve magnification. There is a lens in the eyepiece and another one in the objective.

To find out how many times larger than actual size an object appears when viewed through a microscope, multiply the power of the two lenses.

19. If the microscope has a low-power, medium-power, and a high-power objective lens, which would you use first to focus on an object?

You should always start by focussing with the low-power objective lens.

Comments:

Students are to observe the photographs of micro-organisms and read the descriptions on pages 256 to 259 of *Science Directions 7* to answer questions 20 to 23.

20. Order the five types of micro-organisms from the one that is generally the largest to the one that is generally the smallest.

largest *fungi*
 protozoa
 algae
 bacteria

smallest *viruses*

Note the size, even within each type of micro-organisms, is highly variable, especially for colonial forms.

21. Which types of micro-organisms are unicellular?

viruses, bacteria, some algae, protozoa

22. Which types of micro-organisms are multicellular?

some algae, fungi

23. What is unusual about viruses?

They cannot grow outside the cells of other living organisms. (Students may also indicate their small size.)

Section 2: Activity 2

Observations

Time (minutes)	Level of Dough (cm)
0	<i>Answers will vary. The level should rise during each time interval.</i>
10	
20	
30	
40	

Interpretations

1. What evidence was there that the yeast was multiplying?

In the water, some small bubbles of gas formed. In the dough, the dough rose because of the bubbles formed by the yeast.

2. What do you think you could do to slow down or stop the yeast from multiplying?

Answers will vary. Suitable answers might include lowering the temperature, decreasing the amount of available sugar, or decreasing the amount of available water.

3. Fermentation is a slow chemical change that gives off bubbles of gas. How do you know that growing yeast is an example of fermentation?

The gas (carbon dioxide) formed during fermentation by the yeast causes the bread dough to rise.

Section 2: Activity 3

Experimental Design

1. List three things you could do that might make the bread dough rise more quickly.

Answers will vary. The following are sample answers:

- *increase amount of yeast*
- *increase amount of liquid*
- *increase amount of yeast food*

2. List three things you could do that might prevent the yeast from multiplying or slow down the rate at which the yeast multiplies.

Answers will vary. The following are sample answers.

- *decrease amount of yeast*
- *decrease the temperature*
- *decrease amount of yeast food*

3. Choose one of the conditions (variables) from your answer to question 1 or 2 that you wish to test.

- a. Which variable are you going to test?

Answers will vary.

- b. Do you expect this variable will make the dough rise more quickly or more slowly?

Answer should be consistent with what student stated for question 1 or 2, depending upon which variable they chose to test.

Materials You Need

4. List the materials you will use to test your variable.

- _____ amount of flour
- _____ type of liquid
- _____ type of yeast food
- _____ temperature of water in bowl
- _____ amount of yeast
- _____ amount of liquid
- _____ amount of yeast food

other materials to be used (name or describe the materials or equipment you will use)

- _____
- _____
- _____
- _____

Materials used will vary according to the variable which the student is testing. Check the student's answer to question 5; then return to this question to see that the materials listed here are appropriate for testing the variable described.

Steps to Follow

5. Describe what you are going to do to test your variable.

Answers will vary. Students can use Activity 2 as a guide and compare their results in this activity to their results in Activity 2, or they can devise a new series of experiments. Whatever method the student described, it should effectively test the variable that was chosen in question 3. Check to see that the student keeps all variables the same except the one that is being tested in order to have a controlled experiment. For example, if the student chose to vary the amount of yeast, then all other variables such as amount of flour, type of liquid, temperature of water in the bowl, etc., should be kept the same while the effect of different amounts of yeast is being tested. Check to see that the materials listed in question 4 are appropriate for testing the variable described.

Comments:

You may wish to refer the student to page 352 of the textbook to read Controlled Experiments if the student doesn't have a clear understanding of how to design and do experiments.

Observations

6. Make a chart and record your observations.

Answers will vary. For a controlled experiment at least two parallel experiments (e.g.) treatment A and treatment B, are needed where one is the control and the other tests the effect of the variable that is changed. A sample chart follows.

Time	Height of Bread Dough	
	Treatment A	Treatment B
Start		
1/2 hour		
1 hour		
1 1/2 hours		
2 hours		
2 1/2 hours		

Interpretations

7. a. Did the variable you chose to test cause the yeast to multiply more quickly or more slowly?

Answers will vary depending on which variable was chosen.

- b. How do you know?

In comparison to normal yeast multiplication observed in Activity 2, the yeast multiplied more quickly or more slowly depending on variable chosen.

Section 2: Activity 4 (Optional)

Comments:

This is an optional activity. If the choice is made not to watch the video program for this activity, or if the necessary videocassette is not available, the student may omit Activity 4 and move on to the Follow-up Activities.

The videocassette for this activity is called *Microbeasts and Disease*. The term *microbeasts* means micro-organisms. The program was made in England. Also, at times the sound track is hard to hear because of background noise. If the student has trouble understanding what is being said, the videocassette may be stopped and rewound so that it can be listened to again.

The student is to answer the following questions in full sentences. To do this, the videocassette may need to be stopped while answering the questions. The questions are based on the first 10 minutes of the video program. After the questions have been answered, the videocassette should be stopped. The rest of the video program will be watched in later sections of this module.

1. How did the bubonic plague get to the village of Eyn in 1665?

The tailor had some cloth brought down from London; something in the cloth carried the disease.

2. How did the people of the village avoid spreading the disease?

They stayed within their village. No one entered and no one left.

3. What was Dr. Jenner's theory on why milkmaids never caught smallpox?

Usually milkmaids had suffered cowpox disease. Jenner's theory was that, having had cowpox, a person was somehow immune from smallpox.

4. Dr. Jenner's research and his treatment of the boy is shown in a humorous way. What was the serious job that Dr. Jenner was trying to do?

He was trying to find the cause and cure for smallpox.

5. How did Dr. Jenner test his theory?

He performed his test on a young boy who had suffered neither disease. First he caused the boy to contract cowpox disease. Later, he could not give the boy smallpox by the same method.

6. What was the result of Dr. Jenner's experiment?

Smallpox has been all but wiped out by Edward Jenner's vaccination process.

7. What was found on the tip of a pin after several magnifications?

After about 1500X magnifications, micro-organisms were found on the tip of the pin.

8. How do microbeasts (micro-organisms) grow?

Each micro-organism divides into two, and then each of these divide into two more.

9. If you started with one micro-organism that could divide into two micro-organisms every 20 minutes, how many micro-organisms would you have after

- a. one hour?

$$2 \times 2 \times 2 = 8 \text{ micro-organisms}$$

- b. three hours?

$$2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 = 512 \text{ micro-organisms}$$

10. a. After collecting samples from different surfaces and spreading them on agar plates, where are the dishes placed?

The dishes are placed in a warm location.

- b. Why?

The warmth encourages the growth of the micro-organism.

11. What makes bread go mouldy?

The mould grows because the bread provides food and moisture.

Comments:

After the part on bread mould, the student should stop the videocassette. The rest of the videocassette will be watched in the next section of this module.

Section 2: Follow-up Activities

Extra Help

1. What does micro-organism mean?

Micro-organism means a very small living thing.

2. Why is it so difficult to see micro-organisms?

They are too small to be seen with the naked eye; a microscope is necessary.

3. What do bacteria, viruses, algae, protozoa, and fungi have in common?

Most are unicellular (made up of single cells).

4. What evidence suggests that micro-organisms are living?

Answers will vary. Sample answers are given.

- *They can reproduce and grow.*
- *They use the energy of the food that they live in.*
- *Most micro-organisms have a cellular structure.*

Enrichment

1. Fleming's discovery of penicillin has been called accidental. What do you think?

Answers will vary. The student's answers should show creative and critical thinking skills in recognizing that a successful scientist performs tests to prove or disprove his or her ideas but is always open to new ideas.

2. Micro-organisms are helpful and harmful to humans. Explain what this means.

Answers will vary. The student's answers should reveal an understanding of the advantages (e.g., food-making and breaking down of wastes) and disadvantages (e.g., disease causing) of the existence of micro-organisms.

Section 2 Assignment

(31 Total Possible Marks)

Comments:

Although the value assigned to each question is the decision of the classroom teacher, suggested values are given in brackets as a guide.

1. List three conditions micro-organisms need to be able to grow and multiply. (3)

- *availability of a food source*
- *moisture*
- *appropriate temperature conditions (generally warm conditions most enhance growth)*

Students may also indicate the presence of oxygen as another necessary condition. Credit should be given for this answer, but the marker might indicate to the student that some micro-organisms do not require oxygen.

2. Micro-organisms have been around for millions of years indicating their success as a group. Why haven't they all died? State two reasons why they are successful. (4)

Answers will vary. Award two marks for any two of the following significant answers:

- *Micro-organisms survive and grow in a wide variety of conditions.*
- *Micro-organisms can reproduce very rapidly.*
- *Micro-organisms can survive in unfavourable conditions for extended periods of time.*

3. Micro-organisms will live where they can get food. Match each habitat with the likely food of the micro-organisms living in that particular habitat. Write the number of the food in the blank space by the letter representing the habitat. You can use a number more than once. (10)

Habitat		Food of the Micro-organism
a. soil	<u>3 or 9</u>	(1) ingredients in milk
b. mouth	<u>7</u>	(2) dead cells
c. milk	<u>1</u>	(3) dead plants and animals
d. your skin	<u>2</u>	(4) starch and sugar
e. chickens	<u>8</u>	(5) ingredients inside a wheat grain
f. toothbrush	<u>7</u>	(6) your tissues
g. bread dough	<u>4</u>	(7) food particles
h. pond	<u>3 or 9</u>	(8) muscle tissue
i. cut on your finger	<u>6</u>	(9) other micro-organisms
j. wheat kernels	<u>5</u>	

4. Why did people not know about micro-organisms 400 years ago? (2)

Key points that might be made here are that micro-organisms are not visible to the unaided eye and that microscopes had not yet been developed.

5. When Susan told her younger brother she was studying micro-organisms at school, he replied, "Why study them? They are all so small." How would you explain to him that micro-organisms should be studied? (4)

Answers will vary. Award two marks for any two of the following acceptable answers.

- *Micro-organisms are very numerous and widespread.*
 - *Human health and disease have a great deal to do with micro-organisms.*
 - *Human foods provide ideal conditions for many micro-organisms.*
 - *Micro-organisms live in human bodies.*
6. "Roberta Recycler flew down from the mountain, across the desert, and down to the edge of a large lake where people had been camping. Bits of orange peel were scattered around a picnic table. With a sigh, Roberta dug a hole, put in the waste, and covered it with soil. She washed her hands and smiled at a passing duck."

In this story, eight different places are mentioned where micro-organisms are commonly found. List them. (8)

- *mountain*
- *desert*
- *lake (or edge of a lake)*
- *orange peel (or waste)*
- *picnic table*
- *soil*
- *hands*
- *duck*

Section 3: Making Decisions!

Upon completion of this section, students should

- understand that micro-organisms obtain energy from food in a variety of ways
- understand that all micro-organisms need energy to be able to grow and multiply
- be able to describe some harmful effects of micro-organisms
- be able to describe some beneficial effects of micro-organisms
- be able to use knowledge of micro-organisms to make personal decisions about safe handling of food

Section 3: Activity 1

Comments:

In this activity students are going to examine foods for evidence of micro-organisms. They should use as many of the suggested foods as possible. Some may have been treated to prevent micro-organisms from growing on them. However, students will likely not see evidence of the treatment on the foods.



Under no circumstances are students to open the containers for a closer look at the food. There shouldn't be micro-organisms harmful to humans in the food, but there may be. Students must treat the food as potentially dangerous. If they are doing this activity at home, they should tell all family members about the potential danger of opening the containers. If there are very young children at home, the foods are to be kept in a place where the children cannot get at them.

Upon completion of this activity, the student should put all the foods used into a large plastic bag, seal the bag, and put the bag into the garbage.



Observations

Describe any changes that have taken place.

Food	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6
orange or lemon	<p><i>Answers will vary. Students should describe any changes in colour, texture, or shape, and they should note the presence of any growing materials that may be found on the foods.</i></p>					
grapes						
apple slices						
potato slice						
green beans						
zucchini or cucumber slices						
bread						
cottage cheese						
milk						
milk and soil						

Interpretations

1. Describe evidence for the growth of micro-organisms on each of the following foods.

- a. orange or lemon
- b. grapes
- c. apple slices
- d. potato slice
- e. green beans
- f. zucchini or cucumber slices
- g. bread
- h. cottage cheese
- i. milk
- j. milk and soil

Answers will vary according to the particular micro-organisms that establish themselves in the food. Student answers should focus on change of colour, texture, shape, and the presence of growing material that may be found on the food. The answers given here should be based on the descriptions stated in the observations chart.

2. Why do you think the spoilage on each food looked somewhat different?

Different types of bacteria feed on different foods and produce different symptoms.

3. a. Which had the most micro-organisms, the milk or the milk with soil?

milk with soil

b. What evidence do you have for this?

There was a greater amount of curdling and a stronger smell.

c. Why do you think it had more micro-organisms than the other sample?

The soil contains numerous micro-organisms.

4. a. List any foods that did not show evidence of decay.

All of the foods should show signs of decay.

- b. Give reasons why they did not decay.

Answers will vary. Normally the reason for lack of evidence of decay is related to the presence of inhibitors in the food (either natural or artificial), or the lack of a suitable site for decay to establish itself.

5. List four conditions that are needed for micro-organisms to grow.

- *food source*
- *moisture*
- *warmth*
- *darkness*
- *presence of oxygen*

Comments:

Although many micro-organisms prefer dark conditions over bright conditions to grow in, this doesn't apply to all micro-organisms as some micro-organisms do well in light.

Students may also indicate the presence of oxygen as another necessary condition. Credit should be given for the answer, but the marker might indicate to the student that some micro-organisms do not require oxygen.

Section 3: Activity 2

Story A

You and your family drove for an hour to a picnic site. For the next two hours you walked through the forest, watched squirrels, and threw rocks into a pond. When it was time to eat, your father set out the food that had been packed in a cardboard box and had been sitting in the trunk of the car. One of the items was a 250 mL carton of chocolate milk.

1. a. Would you drink the milk?

probably not

- b. Why or why not?

Assuming the outside temperature is warm enough for a picnic, this warm temperature is ideal for micro-organism growth.

2. If you do not think the milk is safe, how could you have handled it differently so it would be safe?

Answers will vary. Student answers should reveal an understanding that cooler temperatures would be better for preserving the milk.

Story B

You have just purchased oranges or lemons from the store. They were in a refrigerated bin. When you arrived home you had to decide where to store them.

Use the information you gathered in Activity 1 regarding the spoiling of oranges or lemons as your scientific knowledge about the spoiling of oranges or lemons. Then decide where you will store them at home. Will you store them in a bowl on the counter or in the refrigerator?

3. Where should the oranges or lemons be stored?

They should be stored in the refrigerator. Only the ones that will be used soon should be put in a bowl.

4. Why did you choose the method of storage you did?

Cool temperatures stop the action of micro-organisms.

Section 3: Activity 3

1. Each of the original foods has been changed in some way by micro-organisms. In each case the original food has had at least three things altered:

- taste
- texture (how it feels)
- appearance

For each of the following processed foods, list one main difference from the original food.

Answers will vary. Sample answers follow:

- a. milk → cheese

Cheese is a solid, whereas milk is a liquid.

- b. cocoa bean → chocolate

The bean is a solid lump. The cocoa is a finely divided solid (a powder).

- c. coffee bean → coffee

The bean is a solid lump. The coffee is a finely divided solid (a powder).

- d. soya bean, wheat → soya sauce

Beans and wheat are solids. Soya sauce is a liquid.

- e. soybean milk → tofu


Soybean milk is a liquid. Tofu is a semisolid (a gel).

- f. grapes → wine

Grapes are a solid fruit with liquid inside. Wine is a liquid.

2. Choose one of the original foods from the chart, and show how the food is changed by fermentation. Use diagrams, pictures, flow charts, or any means you wish to illustrate the change.

Answers will vary. The following is a sample answer.




grapes containing natural sugar

↓

sugar plus yeast (single-celled fungi)

↓ *fermentation*

wine (alcohol)



Section 3: Activity 4

Note: Students are to do either Part A or Part B.

Part A

Caution

This activity should be done under the supervision of a parent or learning facilitator.

Comments:

Yogurt is a good example of a beneficial effect of micro-organisms. In this activity students are to follow the instructions given in the Module Booklet to make yogurt. Check to see that the student is following the instructions stated while making the yogurt.

1. Why do you think it was important to keep the mixture at 45°C?

This is the ideal temperature for growth of yogurt bacteria.

2. You used milk and bacteria to make yogurt. You added 1 L of milk and 10 g of milk powder. How did you add bacteria?

The bacteria is in the yogurt culture.

3. Why do you think the yogurt would taste stronger if you ferment it too long?

The substances produced by fermentation build up and produce a strong flavour.

4. Why should you store yogurt in a cool place after it has been made?

A cooler temperature slows down the multiplication of the micro-organisms.

5. List evidence you observed that there are micro-organisms in the yogurt you made.

Changes in taste, appearance, and texture occurred as evidence.

Part B

Observations

The bacteria used to make yogurt must meet three conditions before they will multiply. In the following chart, list the conditions. Then describe how those conditions are met when making yogurt. (To get you started, one of the three conditions has been identified for you.)

Conditions	How the Conditions Are Met
• The bacteria must have food for growth.	<i>Milk is the food source.</i>
• The bacteria must be placed in the correct temperature for growth.	<i>The temperature is kept to approximately 45°C.</i>
• The bacteria must have access to enough water (moisture) for growth.	<i>Milk contains large amounts of water.</i>

Questions to Answer

6. a. Do you think the bacteria in the yogurt have been killed after it has been fully prepared?

no

- b. Give reasons for your answer.

The action of the bacteria has been stopped but will be resumed when placed again in good conditions for growth.

Section 3: Activity 5

Answer the following questions about the story on page 267 of the textbook.

1. List the **producers**, the **consumers**, and the **decomposers** in the story.

Producers	Consumers	Decomposers
grass apple	Michael	mould bacteria

2. List two places where you would expect to find many decomposers.

- soil
- organic matter

3. If there were no decomposers, what would happen to wastes and dead matter in the soil?

They would accumulate and never become available for reuse.

4. If there were no decomposers, what would happen to the amounts of nutrients in the soil?

They would diminish.

5. Continue the story of the apple core, explaining what might happen to the nutrients after they pass from the grass plants.

Answers will vary. Student answers should show an understanding of the grass plants (the producers) containing nutrients eaten and taken up by a consumer (e.g., cow) which in turn are eaten and taken up by another consumer, humans.

Section 3: Activity 6 (Optional)

Comments:

- This activity is optional. If students viewed the videocassette *Microbeasts and Disease* earlier in this module, they should continue their viewing to answer the following questions. If they have not been viewing this program, they should go to the Follow-up Activities.
- To answer the following questions, students should start the videocassette where they left off in Section 2 (about half-way through) and continue up to the end of the sneeze. The last part of the videocassette will be viewed in a later section.

1. What do microbeasts (micro-organisms) in your gut (stomach) help your body to do?

They assist in digesting your food.

2. Why do cows need micro-organisms?

*They assist in breaking down the cellulose in grass. or
They assist in digestion of the cow's food.*

3. How do dairies use micro-organisms?

They are used in the making of cheese and yogurt (to turn milk into cheese or yogurt).

4. What micro-organisms are used in making beer?

Yeast is used to make beer.

5. Once the micro-organisms are added to the liquid, where is the liquid left to develop into malt?

It is left in large, warm tanks.

6. How long does it take for malt to begin to turn into beer?

It happens within 24 hours.

7. Micro-organisms make methane. What is it used for?

It is used as fuel (as fuel for a generator).

8. Many micro-organisms are useful while others are harmful. What are some harmful effects of micro-organisms?

They cause disease.

9. What did Joseph Lister invent? What was it used for?

He invented an antiseptic spray which he used during operations to prevent the spread of disease.

10. How did Florence Nightingale cut the death-rate in hospitals from 40 percent to 2 percent?

*She insisted on keeping things clean. or
She insisted on proper hygiene.*

11. What is one way that micro-organisms can be spread from person to person?

Most students will indicate that micro-organisms can be spread through the air by sneezing, as this was the method shown in the videotape.

Section 3: Follow-up Activities

Extra Help

1. What do organisms use energy for?

They use energy to make their own food, and for food gathering, growth, and reproduction.

2. Where do organisms get their energy?

They get their energy from food.

3. Classify each of the following micro-organisms by writing *producer*, *consumer*, or *decomposer* in the space provided.

- a. producer Diatoms are a type of algae. Diatoms live in oceans and are responsible for over half of the Earth's photosynthesis.
- b. consumer Paramecia are a type of protozoan that feeds on bacteria.
- c. decomposer Moulds are a type of fungus. Some moulds break down dead leaves and trees and return nutrients to the soil in the forest.
- d. producer Euglena are a type of protozoan. Euglena move like animals but make food like plants.
- e. decomposer Some types of food poisoning are caused by bacteria as they break down food.

4. For each of the following situations, food has been changed in some way by micro-organisms. What features of the food are altered? (Your answer might include such features as colour, taste, smell, texture, and appearance.)

- a. milk → cheese

appearance, texture, and taste

- b. grapes → wine

appearance and texture

- c. apple → apple with bruise

appearance and taste

- d. cocoa beans → chocolate bar

appearance, smell, texture, and taste

5. For each of the following situations, food has been changed in some way by micro-organisms. Write *spoiled* or *fermented* in each space.

a. milk → cheese

fermented

b. grapes → wine

fermented

c. apple → apple with bruise

spoiled

d. cocoa beans → chocolate bar

fermented

Enrichment

1. Little Miss Muffet is famous for eating her curds and whey, while sitting on a tuffet. A tuffet is a low stool. What are curds and whey?

Curds are the thick part of the milk which separates from the watery part when milk sours or cheese is made.

Whey is the watery part of the milk which separates from the curd when milk sours or cheese is made.

2. One of the steps in making cheese is curdling milk. What is curdling?

Curdling means to thicken.

3. Most cheddar cheese comes in mild, medium, or sharp form. What does this refer to, and how is it attained?

The terms mild, medium, and sharp refer to the increasing hardness of the cheese. The cheese ripens as the bacteria works. The longer the bacteria works, the harder the cheese and the stronger the smell and flavour of the cheese.

4. How does Roquefort cheese get its colour and strong taste?

Roquefort cheese is made from goats' milk and mould.

5. Some cheeses are quite soft, like cream cheese and cottage cheese. Others are quite hard, like cheddar cheese and parmesan cheese. What is the difference between hard and soft cheese?

Hard cheese is produced as a result of a longer fermentation process than soft cheese.

Section 3 Assignment

(21 Total Possible Marks)

- There is visible evidence when micro-organisms are present in food. List four different kinds of evidence. (8)
 - a change in appearance*
 - a change in smell*
 - a change in taste*
 - a change in texture*
- Match each food with the most likely source of micro-organism that grows in the food. Write the number of the source in the blank space by the letter of the food it represents. You can use a number more than once. (9)

Food		Source of Micro-organism
a. cottage cheese	<u>1</u>	(1) in the cottage cheese
b. milk	<u>4</u>	(2) from the air
c. orange or lemon	<u>3</u>	(3) on the skins of the fruit
d. potato	<u>6</u>	(4) in the milk
e. beans	<u>5</u>	(5) on the vegetable and on its stem
f. zucchini	<u>5</u>	(6) in the potato and on its skin
g. wine or grape juice	<u>3</u>	
h. apple	<u>3</u>	
i. bread	<u>2</u>	

- You have learned many new facts about micro-organisms in this module. Based on your new understanding, answer the following two questions.
 - Name a food that you would prefer not to eat now, that you would have eaten before.

Name of food: *Answers will vary. There is no mark for this answer.*

State your reason: (2) *Student response should focus on the presence of micro-organisms.*

- b. Name a food that you would be willing to eat now, that you wouldn't have eaten before.

Name of food: *Answers will vary. There is no mark for this answer.*

State your reason: *(2) Student responses should focus on the practicality of maintaining particular foods so that there is minimum danger of spoilage or infection.*

Section 4: Food Technology

By the end of this section students should be able to

- describe the difference between processing and preserving food
- describe some technologies used in preserving and protecting food
- provide reasons, based on scientific knowledge about micro-organisms, for using food technologies
- identify alternative approaches to food processing and packaging
- describe several points of view when making a decision

Section 4: Activity 1

Comments:

- Part of this activity, entitled Preserving Apples, is optional and is to be done only by those students who have the proper materials available and a learning facilitator or another adult who will assist the student. This person should work with the student to ensure that all the steps stated in the Student Module Booklet are done safely.
- All students are to answer the questions under Questions to Answer. Those students who were unable to actually do the canning to preserve some sliced apples are still required to read the entire activity to enable them to answer the questions.

Questions to Answer

1. One step in food processing involves separating the parts of the food to be preserved from parts to be discarded. In this activity what parts of the apple were separated from the parts that were to be preserved?

The core and the peel of the apple were separated.

2. Another step in food processing involves changing the size or shape of the food. What changes were made in the size or shape of the material to be preserved?

The apples were sliced to about 0.5 cm thick.

3. A third step in food processing is the preservation of the food. In this step all micro-organisms must be killed or prevented from growing.

- a. How were they killed on the apples?

They were killed by the high temperature used in cooking the apples.

- b. How were they killed on the jar and lid?

They were killed by the sterilization of the jar and lid.

4. When preparing the apples in step 5, you were to wipe the top of the jar rim if you got apples on it. Why should you do this?

Pieces of apple on the rim of the jar will interfere with the seal formed.

5. When preparing the apples in step 7, the jar ring was to be unscrewed 1/4 turn after being tightened. Why?

This allows the air above the apples in the jar to escape as it expands when the jar of apples is being boiled. Also, this gives the ring room to expand; otherwise, the ring will stick when the jar and ring cool.

6. Scientific knowledge can often explain why a technology works. Summarize, in the following chart, how canning apples applies scientific knowledge of micro-organisms.

Science Knowledge	Canning Technology
Certain types of micro-organisms are killed when they are boiled for a period of time.	<i>The jar of apples was placed in a saucepan of boiling water for 10 minutes.</i>
Micro-organisms that spoil apples need oxygen to live.	<i>The lid of the jar has a coating of rubber which forms a seal when pressed down. No air can be drawn in and a partial vacuum is formed.</i>

Section 4: Activity 2

1. Why is food preservation by industry becoming a larger part of everyone's life?

Much of the food eaten is transported great distances.

2. Fill in the following chart by briefly describing one advantage and one disadvantage for each method of preserving food.

Answers will vary. The following are sample answers.

Food Preservation Method	Advantage	Disadvantage
Cooling	<i>There is very little change to the taste and texture of the food.</i>	<i>Over time there is some spoilage. (There is a limit to how long food can be stored this way.)</i>
Freezing	<i>Growth of micro-organisms is stopped while the food is frozen.</i>	<i>Some foods do not freeze well. (The texture changes.)</i>
Canning (Using Mason Jars)	<i>Companies can preserve and package food on a large scale.</i>	<i>Glass can be broken during handling and transportation.</i>
Canning (Using Metal Cans)	<i>This will kill micro-organisms in food.</i>	<i>Soldered joints sometimes leave small gaps through which air and micro-organisms could enter.</i>
Artificial Additives	<i>This will kill micro-organisms in food.</i>	<i>Some people have allergic reactions to these artificial additives.</i>
Freeze Drying	<i>The food becomes light-weight.</i>	<i>This is expensive to produce.</i>
Irradiation	<i>This will kill micro-organisms in food.</i>	<i>Long-term effects on human health are unknown.</i>

Section 4: Activity 3

- Decide which type of meat you would take on the backpacking trip, Explain why you made your decision by referring to points of view.
 - Which type of meat would you take?

Answers will vary.

b. Why?

Answers will vary but the student's answers should exhibit an element of critical thinking regarding the various factors involved in decision making.

2. Read the information about each of the following food preservation methods. One advantage and one disadvantage has been stated for each method. Identify which of the six points of view each statement represents; then write it in the space provided. An example has been done for you.

- a. Drying: Moisture is removed from the food so that micro-organisms cannot multiply (as in the drying of apples).

Advantage: This is an inexpensive process that can be done at home.

Point of View Represented: Economic

Disadvantage: Drying takes a long time to do and it requires great effort.

Point of View Represented: Personal Preference

- b. Ultra High Temperature: Food is heated to a temperature high enough to kill all micro-organisms; then it is stored in air-tight containers.

Advantage: Once micro-organisms have been killed, they cannot multiply.

Point of View Represented: Scientific

Disadvantage: This process changes the taste of food.

Point of View Represented: Personal Preference

- c. Canning (Mason Jars): This is the process you used to process apples in Activity 1.

Advantage: The glass jars can be used again once the contents have been eaten.

Point of View Represented: Environmental

Disadvantage: Tests have shown that the high temperatures used destroy some vitamins and minerals.

Point of View Represented: Scientific

- d. **Irradiation:** This is one of the newer food processing technologies in which food is sterilized by deadly gamma rays. The food is not radioactive once removed from the radiation.

Advantage: Irradiated food can be shipped long distances without refrigeration.

Point of View Represented: Economic

Disadvantage: The long-term effects on human health are not known.

Point of View Represented: Scientific

Section 4: Follow-up Activities

Extra Help

Preparing food to prevent the growth of micro-organisms is called preserving food. Many different methods have been developed. Here is a list of some that have been discussed in the module.

- canning, using jars
- canning, using metal cans
- artificial additives
- freeze-drying
- irradiation
- cooling
- freezing
- salting
- drying

1. List two methods that remove moisture to preserve food.

Answers will vary. The following are sample answers.

- *drying*
- *salting*

2. List two methods that lower temperatures to preserve food.

- *freeze-drying*
- *cooling*

3. List two methods that kill micro-organisms and prevent them from entering the food.

- *artificial additives (or chemical additives)*
- *canning using jars*

Comments:

Students are to consider the six different points of view discussed in this section in order to make informed decisions when answering questions 4 to 9.

4. "Canned meat is much cheaper than freeze-dried meat." Which point of view is this statement considering?

economic

5. "When in the mountains, some people will leave cans laying around because they take up room in their packs. But the plastic bags from freeze-dried foods can be folded and carried away." Which point of view is this statement considering?

environmental

6. "Canned meats look and taste like fresh meat, but freeze-dried meats look bland and taste quite dry." Which point of view is being considered in this statement?

aesthetic

7. "Cans often become dented, letting in air and micro-organisms that will spoil the food. Freeze-dried foods contain no moisture, and so leaving them open to the air is fairly safe." Which point of view is being considered here?

scientific

8. "Canned meats contain quite a bit of water, making them heavy to carry. Freeze-dried meats are very light." Which point of view is being considered in this statement?

personal preference

9. a. If you had to choose between canned meat and freeze-dried meat for a backpacking trip, which would you choose?

Answers will vary.

- b. Why?

Answers will vary. Student answers should show critical thinking skills regarding the various factors in decision making.

Enrichment

Note: Students are to do either Part A or Part B, but they may do both parts if they wish.

Part A

Comments:

If students viewed the videocassette *Microbeasts and Disease* earlier in this module, they may wish to continue their viewing in Part A. Questions 1 to 7 are based on the portion of the video program from where they left off in Section 3 (from after the sneeze) to the end of the program.

1. What was the first suspect in the sickness of the nine students?

The food eaten by the students at a school dinner was first suspected.

2. What does the *stomacher* do?

It churns up the food. (It makes it into a broth.)

3. a. Of all the bacteria colonies that were grown, were any of them dangerous?

No.

- b. What does this prove?

The school dinner was not responsible for the illness.

4. As more people become ill, what was the next step for the environmental health officer?

He had to make observations and gather information.

5. a. What was the second suspect in the spreading illness?

The milk supply was the next suspect.

- b. What was the result of the agar growth?

No dangerous micro-organisms were found.

6. a. What was the third suspect in the spreading illness?

The water supply was the third suspect.

- b. What were the results?

The water was shown to be contaminated.

7. What would you do to stop the spread of the illness?

Some form of water treatment such as boiling the water or using bottled water from outside the area could be used. Treatment of the water source would be another way to correct the problem.

Part B

Write six regulations that you think should apply to hot dog vendors. Give reasons for why you chose each regulation.

Comments:

Answers will vary. Sample answers follow.

1. Regulation:

All wieners shall be kept cool until time of cooking.

Reason:

Growth of micro-organisms is stopped under conditions of cool temperatures.

2. Regulation:

Once cooked, wieners should be kept very hot until served.

Reason:

Growth of micro-organisms is stopped under conditions of high temperature.

3. Regulation:

All utensils used in food preparation shall be sterilized.

Reason:

Micro-organisms on the cutlery from handling will be killed.

4. Regulation:

The wieners should be covered both before cooking and after heating.

Reason:

Covering the wieners will prevent materials from falling on the food or flies from landing on it.

5. Regulation:

Once heated, wieners should be consumed within that day.

Reason:

The longer the food is kept, the greater the likelihood of spoilage.

6. Regulation:

All hot dogs should be handled with utensils, not the hands.

Reason:

Micro-organisms could be transferred to food by hand.

Section 4 Assignment

(26 Total Possible Marks)

1. In deciding which type of container to use, there are many factors you might want to consider, such as the cost, the effects on the environment, and package appeal. For each of the following considerations, rank the three types of containers. Put what you think is the best choice first. An example has been done for you. Note that you are also required to give a reason for the way you rank the three containers.

Example: cost to customer

- (1) cardboard
- (2) foam polystyrene
- (3) sealed hard plastic

Reason: The cardboard carton of 12 eggs is 25 cents less expensive than the
polystyrene carton and \$1.00 less expensive than the sealed hard
plastic carton.

a. Effect on the Environment (5)

- (1) *cardboard carton or sealed hard plastic*
- (2) *cardboard carton or sealed hard plastic*
- (3) *foam polystyrene*

Reason: *Answers will vary. If the cardboard carton is chosen as the preferred method, it will likely be on the basis that it is biodegradable and is produced from a renewable resource. If the sealed hard plastic is chosen, it would likely be on the basis that it is biodegradable and is made from a resource that is currently in plentiful supply. When foam polystyrene containers are produced, materials called chlorofluorocarbons are released into the air.*

b. Package Appeal (5)

- (1) *sealed hard plastic*
- (2) *foam polystyrene*
- (3) *cardboard carton*

Reason: *The sealed hard plastic has the advantage of being able to take brightly coloured printing and labelling, and at the same time it allows the eggs to be seen through the package. The cardboard carton is least appealing because it does not take coloured dyes well.*

c. Prevention of Breakage (5)

- (1) *sealed hard plastic*
- (2) *foam polystyrene*
- (3) *cardboard carton*

Reason: *The sealed hard plastic is strong and does not need to be opened to examine the eggs. Cardboard is not as strong as the other two materials.*

d. Spoilage Due to Micro-organisms (5)

- (1) *sealed hard plastic*
- (2) *foam polystyrene*
- (3) *cardboard carton*

Reason: *The sealed hard plastic can store eggs for up to a month. The cardboard carton can hold moisture in which micro-organisms could grow.*

2. If you were selling eggs, which type of container would you choose? Why?

Type of Container.

Answers will vary. There is no mark for this answer.

Why? (Give three reasons.) (3)

Answers will vary. Reasons given may focus on the effectiveness of the container, the appeal to customers, storage considerations, and the cost.

3. If you were buying eggs, which type of container would you choose? Why?

Type of Container.

Answers will vary. There is no mark for this answer.

Why? (Give three reasons.) (3)

Answers will vary. Reasons given may focus on the appearance of the container, storage considerations, health considerations, and the cost.

Section 5: Safety Standards

In this section students will learn about

- safety standards which are set for preparing and handling food
- some issues regarding the setting of appropriate safety standards
- problems in regulating and enforcing safety standards

Section 5: Activity 1

1. a. How many levels of government have a role in making decisions in Canada?

There are three levels of government.

- b. Name each level of government.

*federal
provincial
municipal*

2. Decide which level of government is responsible for each of the following problems. The first one has been done for you as an example.

- a. federal Some fish caught near Vancouver Island seem to be contaminated and may cause illness if eaten.

- b. provincial A family needs a licence to open a new restaurant in a small town.

- c. municipal A small community is upset because several of the inhabitants are very ill and must drive 100 km to the nearest hospital.
- d. federal There is controversy about the use of a chemical that makes chickens grow faster and bigger.
- e. provincial Parents want their children tested to find out why so many of them have upset stomachs.
- f. provincial A small company is trying to obtain permission to use a food processing method to make yogurt similar to one that a larger company is using.
- g. federal A store is trying to import a new brand of cheese and wants to have it approved for sale in Canada.

Section 5: Activity 2

- Why does the government make laws about safety standards for food?

The government makes laws about safety standards for food to prevent problems with food before they cause illness and death.

- Why does it take up to two years for the government to pass a law once a concern about safety of food has been identified?

There are many steps in the process.

- What is a compliance proposal?

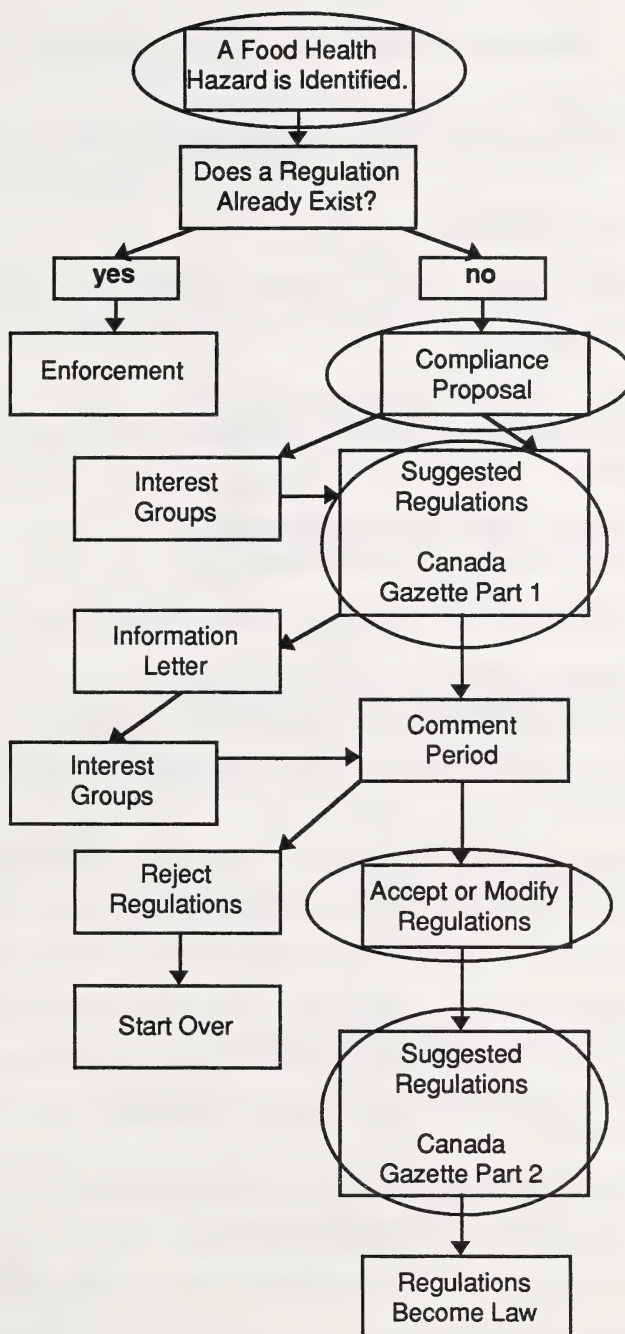
It is a plan containing proposed regulations outlining how a potential hazard can be controlled so that the food product would be safe from any health hazard.

- What is an interest group?

It is a group or association of people who share common interests or similar concerns for some public good.

- The entire flow chart has been put together for you on the following page.

- Identify the places where scientific information and scientists can help the government in setting good safety standards.
- Draw circles on the flow chart to show the places you have identified.



- c. Explain how science can help at each place you circled.

Answers will vary. A sample answer follows.

Science can help to identify hazards and suggest ways to avoid them. Regulations can be made to ensure that known ways to avoid hazards are followed.

Section 5: Activity 3

If you have a concern about food you have purchased, you can call the Health Protection Branch. When you call a Health Protection Branch office, an inspector will ask you several questions and fill out a complaint form.

Read each of the questions which follow, and then ask yourself how the answer would help an inspector investigate your complaint. Explain why you think each of the following questions is important.

1. Question: Where was the product bought?
How will the answer help the investigation?

This will help the investigator to pin down the original source of the problem.

2. Question: When did you purchase the product?
How will the answer help the investigation?

This knowledge will help the investigator identify the time period in which a certain product was sold.

3. Question: Were any people made ill? How many people? How old were they?
How will the answers help the investigation?

This knowledge will help the investigator know the extent of the effects of the food problem.

4. Question: What was eaten at the last three meals before the illness?
How will the answer help the investigation?

This information will allow the investigator to examine possible alternative sources of the problem.

5. Question: Has a sample of the suspected food been kept?
How will the answer help the investigation?

This information will let the investigator know if a sample of suspected food can be tested.

6. Question: Have the original package and contents been saved?
How will the answer help the investigation?

This information allows an understanding of how the suspected food was stored.

7. Question: Were the products bought in quantity, and have all been opened?
How will the answer help the investigation?

This knowledge will tell the investigator whether or not others may have been affected as well.

Section 5: Follow-up Activities

Extra Help

Word List

chemistry	law
federal	micro-organisms
gazette	municipal
growth	provincial
hazards	regulations
illness	safety
inspectors	toxic
laboratories	view

Crossword Puzzle

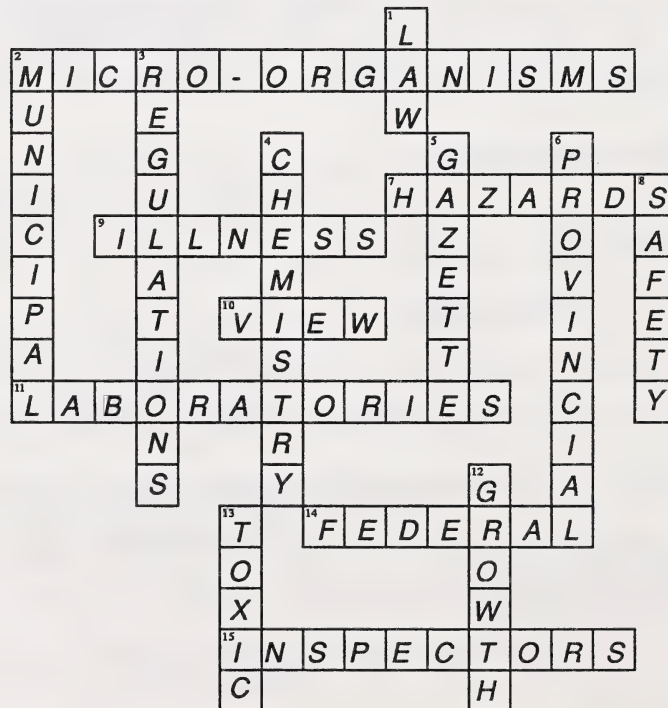
Test your knowledge of how the government sets safety standards by completing the crossword puzzle which follows. Use the words from the word list to complete the crossword puzzle.

Across Clues

2. the cause of food poisoning
7. Scientists help the government identify *hazards*, make new regulations, and investigate complaints.
9. what food poisoning causes
10. A compliance proposal gives the opportunity for looking at different points of *view*.
11. Scientists work in federal *laboratories* to investigate problems with food.
14. The level of government that looks after food processing, storage of food, and food additives.
15. people working for the Health Protection Branch of the government, who look into complaints about food handling

Down Clues

1. what regulations become after being published in the Canada Gazette Part II
2. the level of government that looks after local health units
3. The rules made by government to help ensure a safe food supply.
4. To become a food inspector you must study *chemistry*, food science, microbiology, or pharmacy.
5. Once alternatives are evaluated, suggested regulations are published in the Canada *Gazette* Part I.
6. the level of government that looks after food handling in restaurants
8. To guarantee *safety* of food supplies, standards for food processing must be established.
12. Scientists do tests to find out if cleaning procedures are effective in controlling the *growth* of micro-organisms.
13. a word meaning poisonous



Enrichment

1. Look at the photograph of the canning situation on the middle left side on page 275 of the textbook.

- a. What is the greatest risk of food poisoning in the situation shown in the photograph?

The greatest risk of food poisoning shown is botulism.

- b. How can it be avoided?

Food should be thoroughly cooked before being sealed into jars. The containers should also be washed in very hot water and preserved food could be cooked again just before serving.

2. Look at the illustration on the bottom right corner on page 275 of the textbook.

- a. What type of food poisoning might result from this situation?

Salmonella might result from this situation.

- b. How can it be prevented?

Meat should be refrigerated until it is cooked and then refrigerated again afterwards.

3. Think about the three types of food poisoning. How could these possibly occur in a restaurant? Choose one type of food poisoning to think about further, and answer the following questions.

Which type of food poisoning did you choose? *Answers will vary.*

- a. Write a food regulation for a restaurant that would help avoid this type of food poisoning.

Answers will vary. Student answers should reveal critical thinking skills and an understanding of the type of food poisoning and its preventative measures.

- b. Explain why your regulation would be effective.

Answers will vary. Student answers should reveal a knowledge of science in regard to their chosen regulation.

Section 5 Assignment

(22 Total Possible Marks)

The following chart shows how long certain fresh foods can be kept safely in a refrigerator; some of them could be kept for much longer in a freezer.

Type of Food	Recommended Maximum Storage Time in a Refrigerator
cabbage	4 weeks
carrots	2 weeks
tomatoes	1 week
celery	5 days
corn	2 days
ground beef	1 to 2 days
chicken	4 days
oranges	2 weeks

These guidelines are not regulations made by the government. These guidelines are meant to help you keep food safe to eat once you have grown it or purchased it at a store. You cannot always be sure from looking at a piece of food if it is safe to eat.

1. What kind of information would be used in setting these guidelines? (2)

Answers will vary. The focus of the answer should be on the use of practical tests or experiments to determine the shelf life of each of these materials.

2. a. Should the government make regulations about storage of food in stores and restaurants?

Answers will vary. There is no mark for this answer.

- b. Give reasons for your answer. (4)

Answers should focus on the need for safe food supplies and on ways in which people can be assured that their food supplies are kept safe.

3. Governments have made regulations about listing the contents on all packaged food. (Look at an example of an ingredients label shown on page 291 of *Science Directions 7*.) This list includes all additives. Such a list allows customers to know exactly what they are buying. Knowing what the food contains is especially important for people who have allergies or who must not eat large amounts of certain ingredients, such as salt or sugar.

- a. If you buy food at a farmer's market or from a bulk container in a store, the food is not packaged. Should the government require a listing of contents?

Answers will vary. There is no mark for this answer.

- b. Give reasons for your answer. (4)

Answers should focus on the need for safe food supplies. Some attention should also be given to the need for purchasers to be aware of the content of foods so they can make an informed decision about what products to buy.

4. Some foods that do not contain artificial additives are available in stores. They may be described on the label as "no preservatives added" or "pure."

- a. What is one advantage of food with no artificial additives? (2)

Answers should focus on the negative effects that some food additives may have on some consumers.

- b. What is one disadvantage of food with no artificial additives? (2)

The shelf life of the food will be shorter and the resulting risk of food spoilage or infection will be greater.

5. Government regulations require many food packages to show a "Best Before" date.

- a. How does this regulation help you? (2)

Answers should focus on the need for product information that will guide consumer decisions and actions.

- b. How could science help the government set effective "Best Before" dates? (4)

Answers should focus on the use of practical tests or experiments to determine the shelf life of these materials.

- c. Describe two things that you can do if you notice that a store is selling food after the “Best Before” date listed on the package. (2)

Answers will vary. Award one mark each for any two of the following acceptable answers:

- *Advise the merchant.*
- *Request that the product be removed from the shelf.*
- *Do not buy the product.*
- *Advise a government health authority.*

General Comment:

A final grading for Module 5 can be determined at this point.





This booklet cannot be purchased separately; the
Learning Facilitator's Manual is available
only as a complete set.



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